REMARKS

Claims 1-10 are pending in this application. By this Amendment, claims 1-10 are amended. Support for the amendments to claims 1-10 can be found in the specification as originally filed, for example, at page 4, lines 15-28; page 6, line 36 - page 7, line 4, and in claims 1-10 as originally filed. Also by this Amendment, the specification is amended to correctly indicate the use of trademarks. The specification is also amended to replace Tables 1-3 as originally filed with clearly legible copies thereof; no amendments are made to Tables 1-3. No new matter is added by these amendments.

I. Objections to the Specification

The Office Action objects to the specification for various informalities, including improper content of the Abstract, improper indication of trademarks, and illegible tables. While Applicant does not necessarily agree with these objections, it is respectfully submitted that these objections are overcome by the amendments to the specification, including the provision of clearly legible copies of Tables 1-3, and the provision of a substitute Abstract.

In addition, the Office Action asserts that the term "minimal medium" in Table 3 and on page 16 is unclear, based on the recitation in the claims of "chemically defined medium." Applicants respectfully submit that this objection is unclear, since Table 3 does not include any reference to "minimal medium." Further, Applicants direct the Examiner's attention to page 6, line 36 - page 7, line 6, where chemically defined media and culture media are introduced, and to page 8, line 20 - page 9, line 2, where minimal media for the growth of *Bacillus smithii* is introduced. Applicants respectfully submit that the description of minimal media clearly indicates that minimal media is a chemically defined media. Applicants further submit that one of ordinary skill in the art would have understood the discussion on page 16 to indicate that *Bacillus coagulans* was grown on xylose in a chemically defined minimal

medium, as described on page 8, and that the yeast extract is added merely to increase the biomass concentration, but is not necessary to the conversion of xylose.

Accordingly, Applicants respectfully request withdrawal of the objections to the specification.

II. Rejections Under 35 U.S.C. §112

The Office Action rejects claims 1 and 7-10 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as the invention. While Applicant does not necessarily agree with these rejections, claims 1 and 7-10 have been amended to more clearly set forth the subject matter therein. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Rejection Under 35 U.S.C. §102

The Office Action rejects claims 1-5 and 7 under 35 U.S.C. §102(b) over Payot et al., "Lactic Acid Production by *Bacillus Coagulans* - Kinetic Studies and Optimization of Culture Medium for Batch and Continuous Fermentations," ENZYME AND MICROBIAL TECHNOLOGY, Vol. 24, 1999, pp.191-199, in light of Godshall et al., "Effect of Macromolecules on Sugar Processing: Comparison of Cane and Beet Macromolecules," AVH ASSOCIATION, 9th Symposium, pp. 23-30. Applicant respectfully traverses this rejection.

Independent claim 1 sets forth a "[p]rocess for preparation of lactic acid and/or lactate, comprising: homolactically and anaerobically fermenting a pentose-containing substrate by a moderately thermophilic *Bacillus* species to form lactic acid and/or lactate." Claims 2-5 and 7 depend from claim 1 and incorporate all of the limitations thereof.

The Office Action takes the position that Payot teaches all of the features of claim 1 and dependent claims 2-5 and 7, because Payot teaches producing lactic acid from molasses by *Bacillus coagulans* fermentation. The Office Action asserts that Godshall discloses, in

Table 3, that molasses comprises glucose, xylose and arabinose. Applicant respectfully disagrees.

Payot discloses the fermentation of molasses by *Bacillus coagulans* to form lactic acid. *See generally* Payot. Godshall, which the Office Action relies on in support of its assertion that molasses is a pentose-containing substance, compares the composition of cane and beet sugar macromolecules. *See* Godshall, Abstract. That is, Godshall discloses the compositions of macromolecules of cane and beet sugars, specifically polysaccharides. *See* Godshall, page 26, col. 2, line 5 - page 28, line 26; Tables 3-7. The polysaccharides of cane and beet sugars are made of various units that include arabinose, xylose and glucose. *Id.* However, Godshall only discusses these units as parts of the polysaccharides in cane and beet sugars, not as individual monosaccharides, such as arabinose, xylose and glucose. *See generally* Godshall. Thus, Godshall does not provide support for the position that Payot's disclosure of molasses fermentation teaches fermentation of pentose-containing substrates.

Molasses, the carbohydrate-containing substrate used in Payot, does not, in fact, include pentoses, such as xylose or arabinose. The typical composition of cane molasses, according to United States Sugar Corporation, includes fructose and glucose, which are both hexoses -- sugars having six carbon atoms in their molecules -- and sucrose, a disaccharide formed from fructose and glucose, but does not include any pentoses. *See* Molasses Composition (attached; also available at www.suga-lik.com/molasses/composition.html). Because molasses is not a pentose-containing substrate, as set forth in claim 1, Applicant respectfully submits that claims 1-5 and 7 are patentable over Payot, in light of Godshall, at least because Payot does not disclose fermenting by *Bacillus coagulans* of a pentose-containing substance.

For at least these reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection.

IV. Rejection Under 35 U.S.C. §103

A. Claims 1-5 and 7-9

The Office Action rejects claims 1-5 and 7-9 under 35 U.S.C. §103(a) over PCT International Patent Application Publication No. WO 03/008601 A2 to Green et al. in view of Payot et al., "Lactic Acid Production by *Bacillus Coagulans* - Kinetic Studies and Optimization of Culture Medium for Batch and Continuous Fermentations," ENZYME AND MICROBIAL TECHNOLOGY, Vol. 24, 1999, pp.191-199. Applicant respectfully traverses this rejection.

Claim 1 is as set forth above. Claims 2-5 and 7-9 depend, directly or indirectly, from claim 1 and incorporate all of the limitations thereof.

The Office Action cites Green as teaching a process for homolactically fermenting a pentose-containing substance using moderately thermophilic *Bacillus* species, as set forth in claim 1, and teaches the subject matter of the dependent claims. While the Office Action admits that Green does not teach anaerobic fermentation or separation of the biomass or product, it relies on Payot for its teachings on these subjects. Thus, the Office Action takes the position that the subject matter of claims 1-5 and 7-9 would have been obvious over Green, in view of Payot. Applicant respectfully disagrees.

Green discloses thermophilic bacteria, such as those of the *Bacillus* species, for use in converting monosaccharides, such as arabinose, fructose, glucose and xylose, and disaccharides into (L)-lactic acid. *See* Green, page 3, lines 8-11; page 3, lines 22-24; page 4, lines 24-32; page 5, lines 22-23. In particular, Green discloses aerobic assays using *Bacillus smithii* and *Bacillus coagulans* to produce lactate from arabinose, fructose, glucose and xylose. *See* Green, page 7, line 9 - page 10, line 17.

However, Green does not disclose or suggest anaerobically fermenting pentose-containing substrates to form lactic acid or lactate, as admitted by the Office Action. The Office Action relies on Payot for such disclosures.

As discussed above, Payot discloses the fermentation of molasses by *Bacillus coagulans* to form lactic acid, but does not teach, nor does it suggest, the fermentation of pentose-containing substrates. *See generally* Payot. Molasses is not a pentose-containing substrate, and thus its disclosure in Payot is immaterial to the claimed invention. Payot also does not teach anaerobic fermentation; rather, Payot teaches that biomass is increased with aeration. *See* Payot, page 196, col. 1, lines 13-16.

Applicant respectfully submits that claims 1-5 and 7-9 are patentable over Green in view of Payot, at least because neither reference discloses or suggests anaerobic fermentation by *Bacillus* species. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Claim 6

The Office Action rejects claim 6 under 35 U.S.C. §103(a) over PCT International Patent Application Publication No. WO 03/008601 A2 to Green et al. in view of Payot et al., "Lactic Acid Production by *Bacillus Coagulans* - Kinetic Studies and Optimization of Culture Medium for Batch and Continuous Fermentations," ENZYME AND MICROBIAL TECHNOLOGY, Vol. 24, 1999, pp.191-199, as applied to claims 1-5 and 7-9, and further in view of U.S. Patent No. 4,110,477 to Naruse et al. Applicant respectfully traverses this rejection.

Claim 6 depends from claim 1, which is as set forth above, and further sets forth that the "fermenting is performed by a mixture of moderately thermophilic *Bacillus* species and another lactic-acid producing microorganism." Claim 6 incorporates all of the limitations of claim 1.

The Office Action applies Green and Payot in the same manner as to claims 1-5 and 7-9, discussed above, and admits that Green and Payot do not disclose or suggest that a mixture of bacteria may be used for fermentation. The Office Action relies on Naruse for its disclosures of fermentation by bacteria mixtures. Thus, the Office Action takes the position that Green, Payot and Naruse, in combination, would have rendered the subject matter of claim 6 obvious. Applicant respectfully disagrees.

As discussed above, neither Green nor Payot disclose or suggest anaerobic fermentation of pentose-containing substrate. Naruse does not remedy this shortcoming of Green and Payot.

Although Naruse does teach mixtures of *Bacillus natto* and lactic acid bacteria for fermentation, Naruse does not teach or suggest either anaerobic fermentation or pentose-containing substrates. *See generally* Naruse. Thus, regardless of its actual teachings, Naruse cannot overcome the deficiencies of the combination of Green and Payot. Any combination of the references would still not provide a process that comprises fermentation of a pentose-containing substrate, as claimed.

Applicant respectfully submits that claim 6 is patentable over Green in view of Payot and Naruse, at least because none of the references discloses or suggests anaerobic fermentation by *Bacillus* species. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Claim 10

The Office Action rejects claim 10 under 35 U.S.C. §103(a) over PCT International Patent Application Publication No. WO 03/008601 A2 to Green et al. in view of Payot et al., "Lactic Acid Production by *Bacillus Coagulans* - Kinetic Studies and Optimization of Culture Medium for Batch and Continuous Fermentations," ENZYME AND MICROBIAL TECHNOLOGY,

Vol. 24, 1999, pp.191-199, as applied to claims 1-5 and 7-9, and further in view of U.S. Patent No. 5,002,881 to Van Nispen et al. Applicant respectfully traverses this rejection.

Claim 10 depends from claim 7, which in turn depends from claim 1, which is set forth above, and further sets forth that the "subjecting the lactic acid and/or lactate to one or more purification steps after separating the lactic acid and/or lactate from the fermentation broth, wherein the moderately thermophilic *Bacillus* species is grown on a chemically defined medium," with claim 7 introducing the separation of lactic acid and/or lactate from the fermentation broth. Claim 10 incorporates all of the limitations of claims 1 and 7.

The Office Action applies Green and Payot in the same manner as to claims 1-5 and 7-9, discussed above, and admits that Green and Payot do not disclose or suggest purification steps, as set forth in claim 10. The Office Action relies on Van Nispen for its disclosures of processes for fermenting organic acids in which bacteria are separated from the culture medium and impurities are removed. Thus, the Office Action takes the position that Green, Payot and Van Nispen, in combination, would have rendered the subject matter of claim 10 obvious. Applicant respectfully disagrees.

As discussed above, neither Green nor Payot disclose or suggest anaerobic fermentation of pentose-containing substrate. Van Nispen does not remedy this shortcoming of Green and Payot.

Although Van Nispen does teach mixtures of *B. coagulans* and lactic acid bacteria for fermentation, Van Nispen does not teach or suggest either anaerobic fermentation or pentose-containing substrates. *See generally* Van Nispen. Thus, regardless of its actual teachings, Van Nispen cannot overcome the deficiencies of the combination of Green and Payot. Any combination of the references would still not provide a process that comprises fermentation of a pentose-containing substrate, as claimed.

Further, the skilled person intending fermentation of pentose-containing sugars, starting with the teachings of Green, would not have been motivated to combine the teachings of Green with the teachings of Payot and Van Nispen.

As discussed above, Green discloses a fermentation process of pentose-containing sugars, using *Bacillus* bacterium. The Green fermentation processes are unambiguously disclosed as aerobic processes only. *See* Green, page 7, line 9 - page 10, line 17. As also discussed above, Payot discloses the fermentation of molasses by *Bacillus coagulans* to form lactic acid, but does not teach or suggest fermentation of pentose-containing substrates. *See generally* Payot. Van Nispen discloses the use of *B. coagulans* for anaerobic fermenting a medium that contains glucose, which is a hexose-containing sugar. *See* Van Nispen, col. 3, line 55 - col. 4, line 67. Van Nispen does not contain any disclosures relating to the fermentation of pentose-containing sugars. Thus, one of ordinary skill in the art, having the knowledge of Green and looking for further information on fermenting pentose-containing sugars, would not have relied on the teachings of Payot or Van Nispen. Thus, Green, Payot and Van Nispen, individually or in combination, would not have rendered claim 10 obvious.

For at least the above reasons, Applicant respectfully submits that claim 10 is patentable over Green in view of Payot and Van Nispen, at least because none of the references discloses or suggests anaerobic fermentation by *Bacillus* species. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

V. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-10 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

William P. Berridge
Registration No. 30,024

Julie M. Seaman
Registration No. 51,156

WPB:JMS/jms

Attachment:
Molasses Composition (2 pages)

Date: March 8, 2005

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

MOLASSES COMPOSITION

UNITED STATES SUGAR CORPORATION
Molasses & Liquid Feeds Division
P.O. Drawer 1207
Clewiston, Florida 33440

09/29/03
Typical Composition of
U. S. Sugar's Heavy Mill Run Cane Molasses

Brix, spindle	86.0 degrees
Weight/gallon	11.8-12.0 lbs
Nitrogen	1.01 %
Crude Protein	6.30 %
Total Sugars	48.3 %
Density (as fed)	11.8 lbs/gal
Dry Matter	76.5 %
Moisture	23.5 %
Ash	16.0 %
Organic Matter	62.5 %
Reducing Substances, as Dextrose	11.5 %
Sucrose	35.9 %
Fructose	5.6 %
Glucose	2.6 %
pH	4.9 - 5.4
Calcium	0.8 %
Phosphorus	negligible (not for use)
Potassium	4.2 %
Chloride	2.1%
Magnesium	0.27 %
Sulfur	0.78 %
Sodium	0.09 %
Copper	14 ppm
Iron	130 ppm
Manganese	5 ppm
Zinc	8 ppm
Cobalt	negligible
Iodine	negligible

C: N approx. ~ 27
2001 NRC Dairy Cattle
TDN @ 1x maint. = 62.4%
NEm @ 3x maint. = 66.8mcal/lb
NEg @ 3x maint. = 44.8mcal/lb
NEl @ 3x maint. = 58.1mcal/lb